crispness. Often in white or delicate shades. Uses: Dresses.

Outing flannel.—Plain-woven or twill-woven fabric. Heavily napped on one or both sides. White, plain, striped, or checked. Uses: Underwear, sleeping garments.

Oxford shirting.—Basket weave or twilled. Mercerized. White, plain colors, or stripes. Uses: Suits, shirts. (Fig. 24.)

Percale.—Plain, closely woven, lightweight fabric with a dull finish. Contains more sizing than muslin but without the gloss of cambric. More closely woven than ordinary calico. White or printed either by direct or discharge method. Uses: Dresses, aprons, shirts, blouses.

Percaline.—Plain-woven, highly calendered percale. Sometimes moiréd. White or colors. Uses: Underskirts, linings.

Piqué.—French word meaning "quilting," since this fabric was originally woven to resemble quilting. Heavy, durable fabric with raised cords from selvage to selvage. White or colors. Plain or with stripes or figures. Uses: Skirts, dresses, infants' coats. (Fig. 25.) (*See* **Bedford cord.**)

Pongee (cotton).—An imitation of silk pongee. Plain woven with lustrous finish. Filling closer-spaced and of coarser yarns than warp. White or any color, but usually tan, similar to real pongee. Uses: Dresses, shirts.

Poplin (cotton).—Imitation of silk poplin. Ribbed across the cloth. Warp closer spaced and of finer yarns than the filling. Usually mercerized. White or colors. Uses: Dresses, suits, hangings. (Fig. 26.)

Ratiné.—Plain weave of specially twisted novelty yarn. Loosely woven. Always has tufts on the yarn which produce a rough surface. White or colors. Usually white yarn with mottled filling. Uses: Dresses, coats.

Rep (probably corruption of "rib").—Plain weave with heavy filling so introduced as to produce heavy ribs from selvage to selvage. Usually a large or distinct rib is alternated with a small one. Close-spaced warp, usually ply yarns, and very coarse single filling. White or colors. Uses: Upholstery, drapery.

Sateen.—Heavily mercerized fabric. Twill weave with filling thrown to the surface and the surface binding yarns so scattered as to give a smooth lustrous surface. Back shows twill. "Warp sateens" have the typical satin weave. White or colors. Uses: Underwear, draperies, linings.

Scrim.—Coarse, plain, open-woven, strong fabric. Usually mercerized. White, écru, or colors. Uses: Curtains.

Seersucker.—A thin fabric with crinkled stripes resulting from applying different tension to various warp yarns. Plain weave. White or colors. Uses: Night clothing, house dresses, shirts, children's garments; heavier qualities, men's suits.

Serge (cotton).—Cotton fabric with a decided diagonal rib effect. Twill weave. An imitation of worsted serge. White, dyed, or printed. Uses: Skirts, dresses.

Shaker flannel.—Originally a mixed wool and cotton fabric made by a religious sect known as Shakers. Now a cotton or union fabric. Plain or twill weave, napped on both sides. Usually softer and more loosely constructed than outing flannel. Also called "domet." White or colors. Uses: Underwear, night clothing, shirts.

Sheeting (cotton).—In the retail trade this term is usually applied to both bleached and unbleached muslin manufactured in widths suitable for bed sheeting. Plain-woven fabric in a wide variety of constructions, which is used for many household and commercial purposes.

Silence cloth.—Very heavy, double faced, napped on both sides. Made of coarse yarns. White. Uses: Table pads.

Silesia.—Closely woven, very smooth fabric. Twill weave. Highly glazed. White, piece or yarn dyed. Uses: Linings.

Swiss.—So called because first made in Switzerland. A fine muslin, very thin and transparent, stiff and crisp. Usually with pattern of dots or small figures. Genuine dotted Swisses made on swivel looms and imported from Switzerland. Various imitations made in this country. White or colors with white or colored dots or figures. Uses: Dresses, aprons, curtains.

Tarlatan.—Highly sized and calendered thin fabric. Wiry and transparent. Square mesh, plain weave. White or colors. Uses: Millinery, fancy dress garments.

Ticking.—Heavy, durable, twilled fabric, woven with herringbone twill. Usually blue and white warp stripes. White filling.

Art ticking: Satin weave of close construction. Printed stripes or floral patterns of bright colors. Uses: Pillow and mattress covers.

Velour.—Similar to velveteen. Pile weave. Often has other material than cotton for the pile. All colors. Uses: Upholstery, draperies.

Velveteen.—Plain-woven fabric with very short pile. Imitation of silk velvet. White or colors. Uses: Dresses, suits, coats.

Venetian.—Mercerized, closely woven, durable fabric. Satin or twill weave. Very lustrous, silklike finish. White or colors. Uses: Linings chiefly.

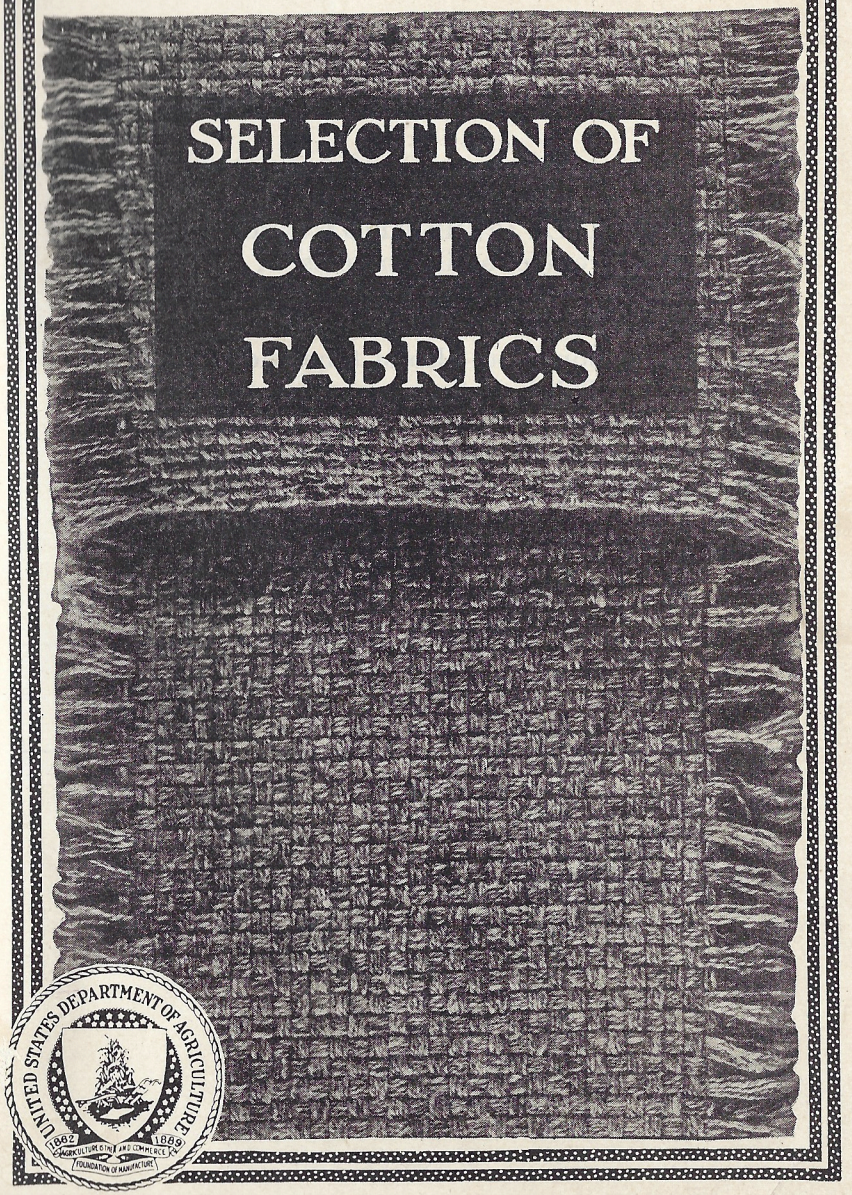
Voile.—Light, sheer fabric. Crisp, "thready" feel. Open construction. White, dyed, or printed. Uses: Dresses, blouses, curtains.

ADDITIONAL COPIES
OF THIS PUBLICATION MAY BE PROCURED FROM
THE SUPERINTENDENT OF DOCUMENTS
GOVERNMENT PRINTING OFFICE
WASHINGTON, D. C.
AT
5 CENTS PER COPY

▽

U. S. DEPARTMENT OF AGRICULTURE

FARMERS' BULLETIN No. 1449



THE GREATER PROPORTION of textiles bought by the average family and most of the garments made in the home are of cotton. Therefore, the careful selection of these materials means the saving not only of money but also of time and effort of the housewife. This bulletin gives information concerning those details of cotton-fabric composition and construction which determine the durability and general usefulness of such materials. It also contains a list of cotton fabrics classified according to their appropriate uses and a glossary of the more important materials.

Washington, D. C.

Issued March, 1926
Revised July, 1931

SELECTION OF COTTON FABRICS

By RUTH O'BRIEN, *Senior Textile Chemist, in Charge of Division of Textiles and Clothing, Bureau of Home Economics*

CONTENTS

	Page		Page
Appropriate fabrics for various uses	1	Finishing	12
Fabric construction	2	Judging the finishing	14
Fiber	2	Dyes	15
Yarn	4	Substantive dyes	18
Weaves	7	Adjective dyes	18
Judging the weave	11	Judging the fastness of the color	19
Knitted fabrics	12	Glossary of some common cotton fabrics	19

OVER eight billion square yards of cotton goods are manufactured and used in this country annually. The great variety of materials and qualities available each season is ample proof of the efficiency of the industry. However, this variety is in itself confusing to the consumer, and the selection of the particular piece best suited to the needs of an individual or a family requires careful thought.

APPROPRIATE FABRICS FOR VARIOUS USES

A fabric must be suitable for the purpose intended or it will not be satisfactory. Cotton, because it is durable, low in cost, and adaptable to many methods of cloth construction, is suitable for an enormous variety of purposes, as shown by the large number of named cotton fabrics on the market. The following list, classified according to suitability, includes the more standard fabrics, but does not, of course, give those that come and go each season. Names such as "flaxon," "India linon," and "silkaline" have been omitted purposely, since their use in connection with fabrics composed entirely of cotton is not considered advisable. All textile trade-mark names are also omitted. Definitions of the standard names are given on pages 19 to 22.

PROTECTIVE CLOTHING (COATS, SUITS, AND OTHER WRAPS)

For women and children.—Bedford cord, corduroy, crash, denim, duck, drill, piqué, pongee (cotton), poplin.

For infants.—Bedford cord, corduroy, gabardine, galatea, piqué, pongee (cotton), poplin, serge (cotton).

OUTERCLOTHING

Dresses for women and girls.—Agaric, albatross (cotton), calico, Bedford cord, challie (cotton), chambray, chintz, crash, crêpe, dimity, duck, éponge, étamine, foulard (cotton), gabardine, galatea, gingham, granite cloth, grenadine, lawn, middie twill, organdie, percale, piqué, pongee (cotton), poplin, ratiné, seersucker, serge (cotton), swiss, voile.

Dresses and gertrudes for infants.—Batiste, dimity, lawn, swiss, voile.
Shirts for men and boys.—Broadcloth shirting, cheviot shirting, gingham, hickory, khaki, madras, middie twill, Oxford shirting, percale, pongee (cotton).

UNDERCLOTHING

For adults and children.—Batiste, cambric, crêpe, dimity, longcloth, muslin, nainsook, shaker flannel, Canton flannel, outing flannel.
For infants.—Birdseye diaper cloth, Canton flannel, shaker flannel, outing flannel. (See dresses.)

NIGHT CLOTHING

Crêpe, longcloth, muslin, nainsook, Canton flannel, shaker flannel, outing flannel.

LININGS

Cambric, crinoline, lawn, nainsook, net, sateen, silesia, Venetian.

HOUSEHOLD PURPOSES

For bedding.—Muslin, muslin sheeting, ticking, Venetian.
For curtains.—Bobbinet, cable net, casement cloth, challie (cotton), cheesecloth, dimity, filet net, gingham, lawn, marquisette, organdie, scrim, Swiss, voile.
For draperies, upholstery, and slip covers.—Armure, chintz, crash, crêpe, cretonne, damask (cotton), madras, monk's cloth, osnaburg, percale, poplin (cotton), rep, terry cloth, velveteen.
For towels.—Crash, glass toweling, honeycomb toweling, huckaback or huck, terry cloth or Turkish toweling.

FABRIC CONSTRUCTION

Cotton cloth is made by removing the hairs from the seeds of the cotton plant, twisting these hairs into yarn, weaving the yarns into a fabric, applying a stiffening mixture, and ironing between large rollers. The nature of the fibers used and every one of the manufacturing processes affect the value of the fabric and should be considered when a cotton cloth is being purchased.

FIBER

Since cotton is the cheapest common textile fiber it is usually not adulterated; but sometimes it has been so treated as not to be easily recognized, or other fibers have been mixed with it for various reasons.

Mercerization is the process that changes its appearance and properties most markedly. It is so named because John Mercer discovered many years ago, that, when cotton yarn or cloth is dipped in strong solutions of lye for short periods of time and then properly washed, neutralized, and dried, it becomes much stronger. In later years it was noted that, if the yarn or cloth is held under well-regulated tension during the process, it is rendered glossier as well as stronger. Since the process adds not only beauty but also durability, there are to-day on the market many cotton fabrics in which the entire cloth is glossier and stronger than ordinary cotton materials, or in which these yarns have been introduced to form stripes, checks, or figures. The more or less temporary glossy finishes applied to fabrics by means of paste mixtures should not be confused with

mercerization; nor should the synthetic fibers, some of which are even more lustrous, be mistaken for mercerized cotton.

Many synthetic fibers such as rayon are now available. These were formerly known as artificial silk, fiber silk, glos, and by other trade terms. To-day many carry special trade-marked names, even those that are chemically identical. Most of these synthetic fibers are made of wood pulp or cotton linters. In general the process consists of so treating the cotton or the wood pulp that it can be dissolved and a stiff liquid obtained. This is then forced through minute holes and the tiny streams thus produced hardened by passing them into certain solutions or into rooms of high enough temperature to remove the solvent. In most cases the product has the same chemical composition as cotton or wood pulp. Formerly all such fibers were very glossy, but now many fibers of this kind have only a soft sheen. In general synthetic fibers are not as durable as cotton, some types being very much weaker when wet, and requiring special precautions during laundering.

Paper may be found in many novelty fabrics. (Fig. 1.) It is cheap and although when properly finished will withstand a great deal of wear, it is weakened by water and pulled apart by the friction of ordinary washing processes.

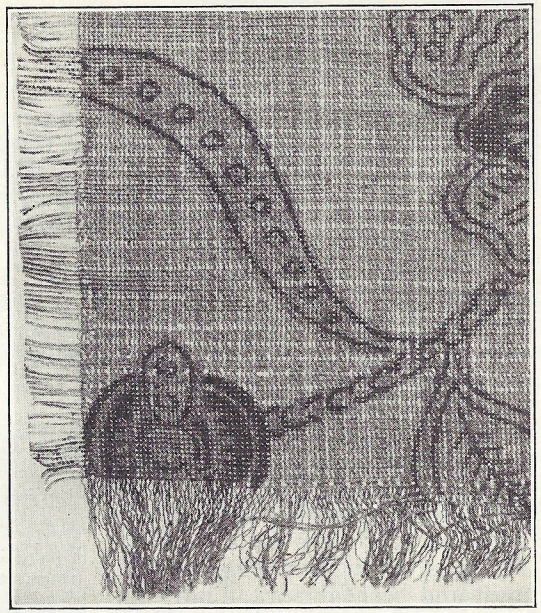


FIG. 1.—An imported drapery fabric with cotton warp and paper filling which will not withstand repeated laundering

Wool and silk are often combined with cotton; but since they are more costly, such a fabric is usually classed as wool or silk and is not considered here.

IDENTIFYING THE FIBER

In order to find out what fibers have been introduced into a fabric, unravel the fabric and separate any yarns that appear to be composed of different materials.

Cotton yarns are fuzzy, due to the projecting ends of the short fibers. They break easily, leaving a brushlike end. Paper yarns are usually made by twisting strips of paper, and are easily recognized when untwisted. Yarns made of synthetic fibers untwist readily and the individual filaments spread apart in more or less fan shape. Mercerized cotton yarn is more glossy and is stronger than untreated cotton yarns, whereas fibers like rayon are often more glossy, weaker than cotton, especially when wet, stiffer, and less pliable.

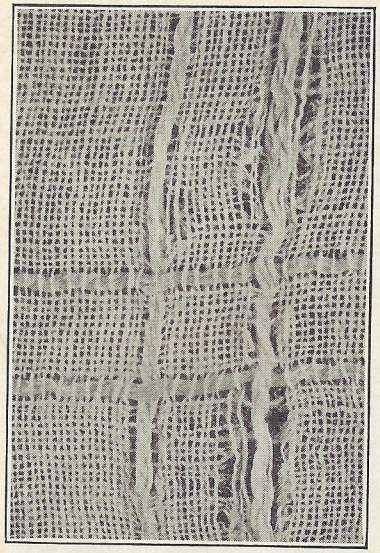


FIG. 2.—Effect of wear and laundering on fabric containing a cord heavier than the adjacent yarns

Most of these fibers burn with a flash, leaving a very small pointed end. An exception is cellulose acetate rayon. When burned, this fiber hardens into a brittle ball of ash. Synthetic fibers can readily be distinguished from true silk by burning, as the latter leaves a larger quantity of ash in the form of a ball and gives off an odor like that of burning feathers.

JUDGING THE FIBER

The cotton fiber is a short tube tapering off to a closed point at one end. As the cotton ripens, the fluid that was originally in the tube dries, the walls collapse, and the fiber twists. This twist is an excellent characteristic, as it helps to hold the fibers together and makes a stronger yarn.

Unravel a yarn from the fabric, untwist it, and pull out small tufts of the little fibers which, after all, are the basis of the fabric. Notice whether the fibers are of about the same length or whether this varies a great deal. Compare their average length with that of fibers taken from another fabric. At best cotton is a short fiber, varying in length from less than one-half inch to over 2 inches, depending upon the variety and conditions under which the cotton is grown.

Choose the fabric with the longest fibers of regular length. The finest and best fabrics will have the finest and longest fibers. Short fibers tend to make weak yarns. Their ends become separated from the body of the yarn and give a fuzzy appearance as soon as the starch (sizing) added by the manufacturer is removed in laundering. Not only is this fuzzy effect unsightly, but the fabric catches dirt and becomes soiled more readily.

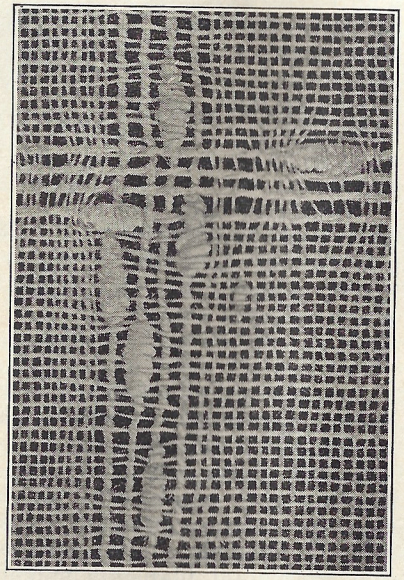


FIG. 3.—A novelty fabric containing irregular yarns which reduce its durability

YARN

Cotton yarns vary in size, regularity, strength, elasticity, and amount of twist. The size of the yarn is called the count and is

specified by a numerical system. If 1 hank of single yarn containing 840 yards weighs 1 pound, the yarn is numbered 1. If 2 hanks weigh 1 pound, it is a No. 2. Thus the finer the yarn, the larger is the count. Yarns numbered from 1 to 20 are known as "coarse yarns" and those from 21 to 40 as "medium yarns." "Fine yarns" are any of higher count than 40s, although the 41s to 60s range is usually known as "medium fine." The count of the yarns used in a fabric depends upon the purpose of the fabric and the design to be developed. The more fiber of a given diameter in each yarn, the heavier that yarn is and the more space it will cover, but also the coarser the fabric will be. Since the strength of the yarn, however, depends more upon the friction developed between the different fibers than upon the strength of each individual one, a large number of fine, well-developed fibers is an advantage in a yarn.

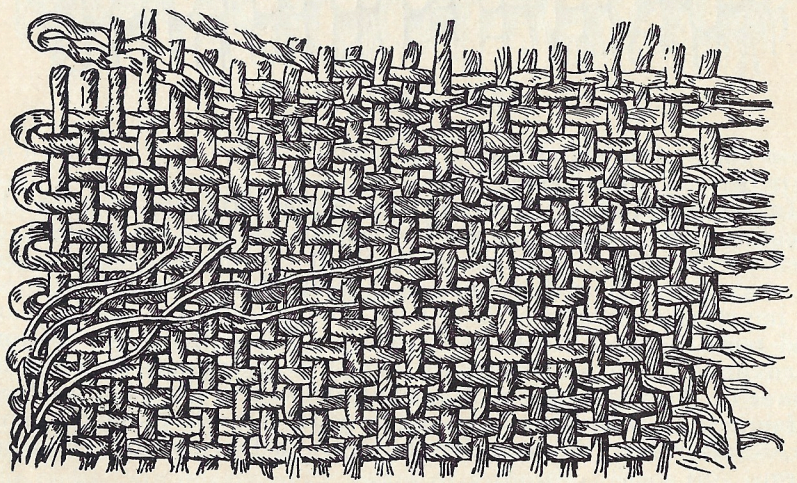


FIG. 4.—The plain or tabby weave

It is also well to notice whether yarns of greatly varying count have been used in the same fabric. Very coarse yarns are sometimes introduced in fine fabrics in order to produce stripes or checks; as, for example, in dimities and poplins. In poorer grades there is a tendency for the finer yarn to break, because the coarse yarn raises the surface fabric at that point and thus exposes itself and the fine yarn crossing it to excessive rubbing and wear. A portion of a handkerchief with this construction is shown in Figure 2. The cord in the border is entirely too heavy for the rest of the fabric and caused an early break which rapidly destroyed the fabric.

Irregular yarns produce lumps which are exposed above the surface of the fabric and wear through quickly. A fabric containing a number of these irregular yarns is shown in Figure 3.

Knots occur in all yarn. In weaving, the warp yarns are under great tension and often break. This also happens occasionally in the filling yarn. The weaver must repair these breaks by tying the two ends of the yarn together. A skillful operator makes a knot that is buried in the fabric, but in cheaper cloths sold as seconds

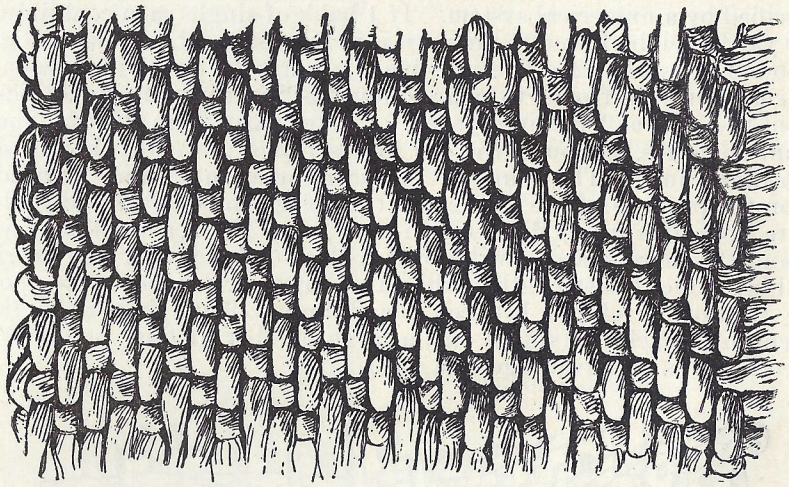


FIG. 5.—The twill weave

these knots often stand out on the surface, where they are worn off or pulled out, thus leaving holes.

In making a choice between two fabrics, strength is often the deciding factor; and it should be remembered that the strength of each yarn contributes to the strength of the whole. A yarn may be weak, owing to such conditions as weak fibers, poor construction, or improper bleaching. Twist adds strength up to a certain point and tends to bind the fibers more closely into the mass. Filling yarns are likely to contain too little twist as this reduces the covering power of the yarn. A small amount of twist in the yarn produces a fabric that soils easily. An elastic yarn recovers its length more or less after distortion and therefore gives a fabric more permanent form.

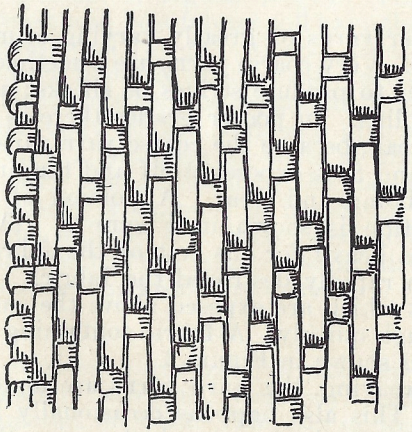


FIG. 6.—The satin weave

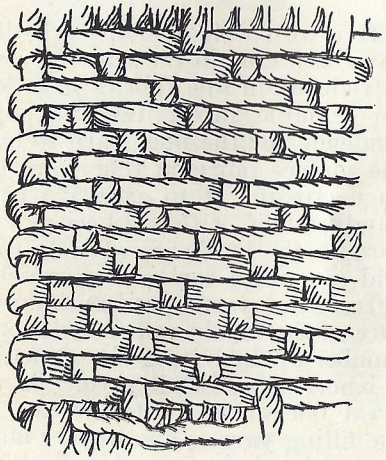


FIG. 7.—The sateen weave

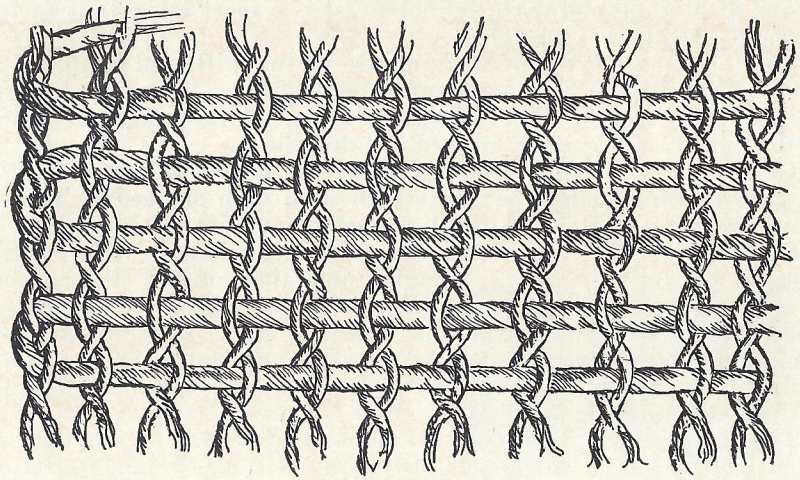


FIG. 8.—The gauze weave

JUDGING THE YARN

Study the fabric carefully, holding it against a strong light if it is thin, and note the characteristics of the yarn. Ravel out a few yarns, break them, and compare the strength with yarns from another similar fabric.

WEAVES

Weaving is the interlacing of yarns to form a fabric, and ranks with knitting and felting as one of the chief methods of producing cloth. In weaving, a set of yarns is held parallel to each other in the loom and is known as the warp yarns, the chain or the ends. Through these the filling yarns, sometimes called "the weft" or "the picks," are interlaced by means of a shuttle. Since this is the

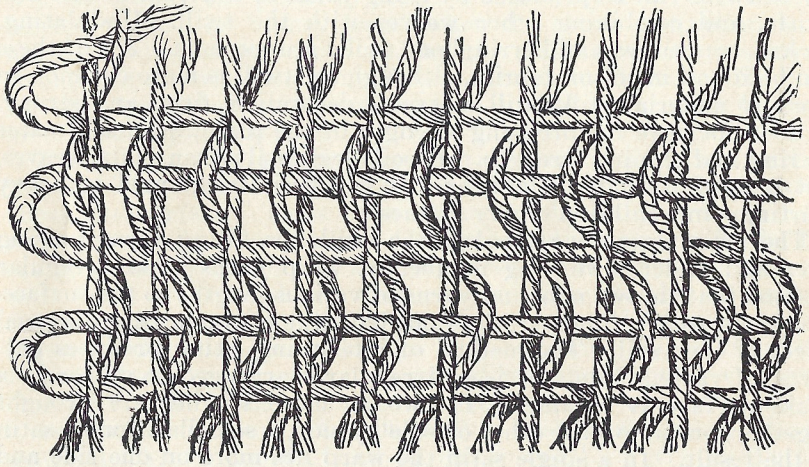


FIG. 9.—The leno weave

58960°—31——2

means of binding one yarn to another, it is a most important factor in the final value of the fabric.

The three main types of weaving are plain, twill, and satin. The demand for beauty and sometimes mere novelty in textile design, however, has brought about many variations of these, some of which unfortunately are neither artistic nor durable.

In the plain, or tabby, weave (fig. 4) the filling yarns pass alternately over and under the warp yarn with each succeeding filling. This produces a fabric with the greatest amount of binding and therefore with the greatest breaking strength, though not with the greatest tearing or ripping strength, since there is less slippage between the yarns. No figures are available showing the comparative resistance to wear; but experience shows that, if regular yarns of almost similar count are used, a very durable fabric is produced. Fabrics of this nature may have defects of yarn structure (p. 4), and a loose, plain weave may result in a sleazy cloth.

The basket weave, in which two or more adjacent warp and filling yarns are woven in as though they were one, is a popular variation of the plain weave, particularly effective in coarser materials, as shown in the cover design. Ribbed weaves in which a group of either filling or warp yarns is treated in this way are also common. These ribbed weaves have the same weakness as heavy yarns combined with finer ones which cause a portion of the fabric to lie above the surface and thus be exposed to more wear (p. 5).

In a twill weave, the filling passes over and under different numbers of warp yarns with regular variation, so that diagonal lines are formed across the fabric. For example, the filling may pass over one warp yarn and under two, then over the next warp yarn and under two more. The next row would do the same, only passing under the first warp, then over the next, under the next two, and so on. (Fig. 5.) The slant of the diagonal lines depends upon the number of yarns the filling passes over and under and whether the warp yarns are finer and closer together than the filling, or the filling finer and closer together than the warp. In fact, an enormous variety of twills can be produced by using yarns of different counts and twists, and combining other weaves with the twill. Undulating, broken, corkscrew, and herringbone twills are common. All of these can be found in cotton fabrics, although the twill is more common in worsted materials. A twill weave is decorative, firm, and strong. It does not have the breaking strength of the plain, but has greater tearing and ripping strength. It soils less easily than plain weaves, but is more difficult to launder. It is especially adapted to heavy skirtings and children's play clothes.

The satin weave is related to the twill, the filling yarns passing over and under a varying number of warp yarns in an irregular fashion that throws unbound yarns of various lengths to the surface. The satin weave, however, does not have the characteristic diagonal effect of the twill. The method of interlacing either produces patterns of various kinds or is so irregularly arranged that merely a plain surface is obtained. If two or more stitches are brought together, one above the other or side by side, a so-called double satin is the result. In a single satin the warp lies more on one side and the filling on the other. When properly constructed, a satin weave produces a fabric not only durable but very beautiful, its most marked characteristic being the smooth, lustrous surface which the word "satin" invariably calls to mind. However, if the unbound yarns, known as floats, are very long, there is danger of their being caught and torn. This is the greatest weakness of the satin weave and must be considered when the fabric is purchased.

If by this method of weaving the filling yarns are thrown to the surface more often, the weave may be termed "a sateen," as distinguished from a typical satin weave in which the warp is thrown to the surface. (Figs. 6 and 7.) However, this use of the terms is passing, and a fabric of this weave containing part cotton is usually considered a sateen regardless of the type of float.

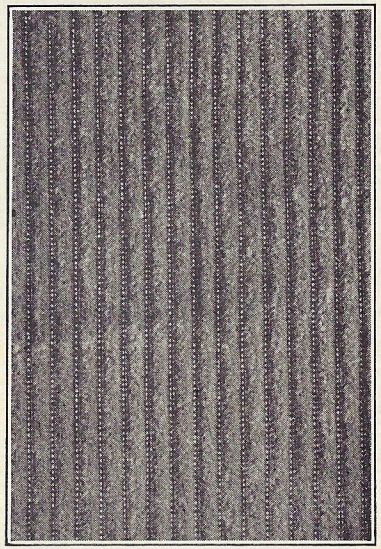


FIG. 10.—Corduroy, a typical pile fabric

The gauze and leno weaves are also common in cotton materials. They are produced by introducing extra warp yarns which twist around the ordinary warps where the weft yarn passes through. The terms are frequently used interchangeably, although in a typical gauze weave (fig. 8) two warp yarns cross each other between the weft yarns, the extra warp passing over every weft. In a typical leno weave there are warp yarns woven in plain, an extra warp passing from one side to the other of each of these, at the same time passing over alternate weft yarns. (Fig. 9.) A combination of the gauze or leno weaves with other weaves, usually the plain, to obtain a more lacy effect is sometimes termed "leno" or "fancy leno" when the above distinction is not made. Owing to the extra binding, the gauze and leno weaves are strong and are wise selections if open fabrics are desired. However, in some cases, the fancy lenos sacrifice durability in order to give a more pleasing appearance.

Pile fabrics (fig. 10) represent a variation of the plain or twill weave. They include those in which either cut or uncut loops extend above the surface. These may be formed by extra weft or extra warp yarns. Most cotton pile fabrics have the extra weft, the best examples being corduroys and velveteens. In such fabrics extra weft floats are left which, when sheared, provide the cut ends of the pile. A twill back permits the pile to be bound in more securely. However, the plain woven back is very common. When the pile is formed by the warp yarns, two sets of warp are usually employed. One set is held in the loom at ordinary tension, while the other is looser and forms loops when the weft is beaten into place. Such a material may be double faced or single faced. Terry or Turkish

toweling is made this way. The loops may be left over the entire surface or distributed in stripes and checks. The fact that the extra surface obtained by this method increases the ability of the fabric to absorb moisture makes the materials valuable as toweling. Another method, more commonly used in carpets, is to insert small

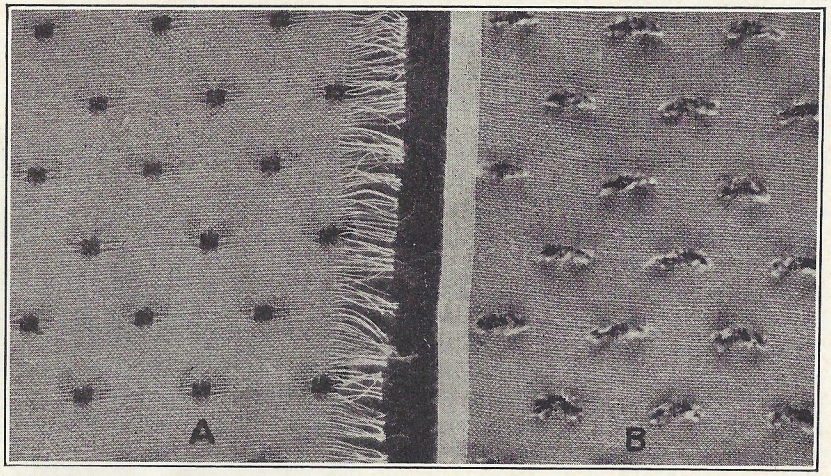


FIG. 11.—Right (A) and wrong (B) sides of fabric showing clipped dots, likely to be pulled out by wear and laundering

wires over which the extra warp passes. When these are withdrawn, more perfectly formed loops are left. If the cut pile is desired, knife edges may be slid in through grooves in the wire and the loops cut without injury to the body of the fabric.

The durability of these fabrics depends entirely on whether sufficient binding yarn is used and is beaten in tight enough to hold the pile. In some cases special precautions have been taken which give excellent results; in others the loop and pile yarns are very easily pulled out of place and the fabric is therefore undesirable. This point should be noticed especially in the case of toweling which must stand hard wear and frequent laundering.

Dots and figures may be produced by variations in the fundamental weaving processes as well as by dyeing and printing devices (p. 15). One simple method is to discontinue the interlacing at uniform intervals, allowing the filling and warp yarns to float unbound across the figure. In a very closely woven fabric this may be done successfully, but usually such fabrics are unsatisfactory. Extra warp or filling yarns may be introduced which continue throughout the entire length or breadth of the fabric, floating on the under side when not needed to form the figure. After leaving the loom, such fabrics are usually run through a machine which clips off this extra material from the under side, producing a "clipped" figure. (Fig. 11.) If the extra yarns are about the same size as those used in the fabric and if it is closely woven, such figures are durable. However, the figures always consist of many short lengths of yarn, and these are more or less readily pulled out.

Figures may be embroidered on a piece of material by an embroidery machine. If only short lengths of unbound yarn are necessary to produce the design, a durable fabric is obtained. The one connecting yarn which floats on the back between the figures may or may not be clipped.

Lappet weaving, in which the designs are stitched on by a set of needles, is easily distinguished by the fact that the extra yarn proceeds lengthwise down the fabric in a zigzag fashion. The figure is not reversible, the extra yarn passing under only one filling yarn at a time, and thus lying almost entirely on the right side of the fabric. The figure may be continuous or the yarn may be clipped between separate designs. (Fig. 12.)

Swivel weaving (fig. 13) differs in that the figures or dots are woven in by tiny shuttles carrying the extra weft, thus producing a result which is usually substantial. One continuous yarn forms the entire figure, unless different colors are introduced. This one yarn may extend to the next figure or may be clipped. It is usually conceded that swivel weaving produces the most durable figures, but it requires expensive machinery.

JUDGING THE WEAVE

Ravel out a small portion of the fabric carefully and classify the weave. Then, keeping in mind the possible defects, study the construction thoroughly and determine whether it is the best of its type. Pull the fabric between the hands and note an excessive amount of

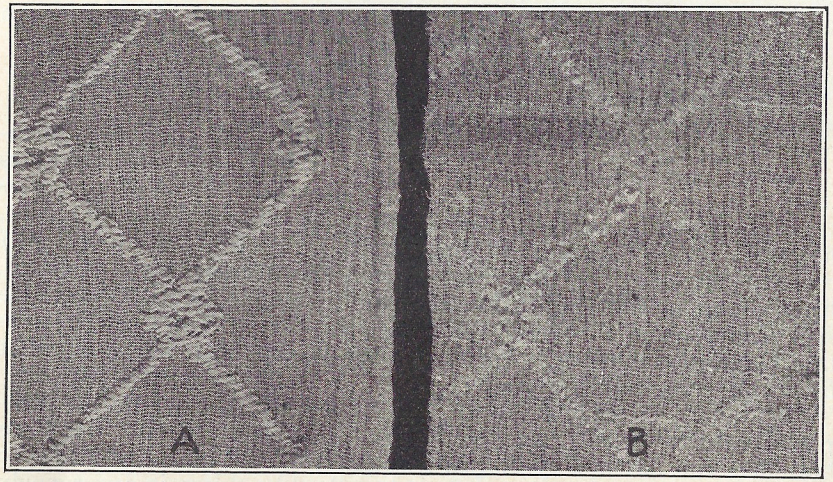


FIG. 12.—Typical zigzag design produced on right side of material (A) by lappet weaving. Complete figure does not appear on wrong side (B)

slippage. Scratch it with the finger nail. If the yarns are readily displaced, the fabric will fray at the seams when used in a garment. Notice the number of yarns per inch both weft and warp way. The closer the weave the more durable the fabric, other things being equal. Excess shrinkage is due chiefly to looseness of weave.

KNITTED FABRICS

Although most cotton fabrics are woven, there are many knitted ones. These are used principally for underwear, although there are some now in vogue for outside garments.

Knitting differs from weaving in that one yarn forms the entire fabric by being fashioned into a series of interlocking loops. (Fig. 14.) Because a knitted fabric is very elastic and porous, it is particularly good for underwear. Since the knitting may be closely or loosely done, fabrics can be made of many different weights. They can also be napped on one or both sides, thus making them very warm.

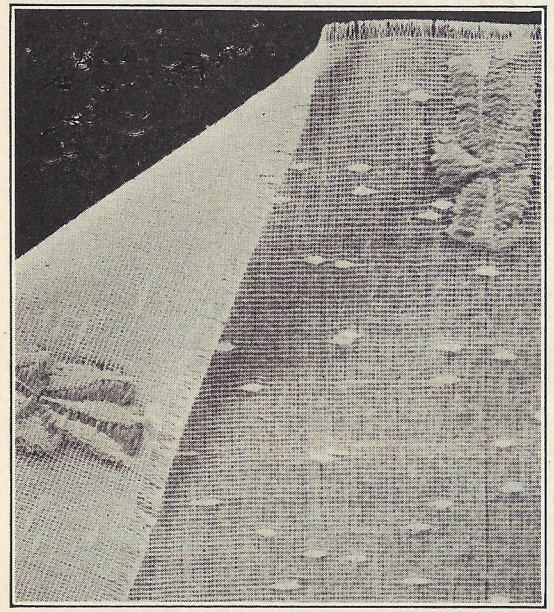


FIG. 13.—Figures produced by swivel weaving

The disadvantages lie in the fact that if the one yarn is broken large holes may be formed very quickly. The fabric is also more easily pulled out of shape than is a woven material. For this reason it is well to choose a closely knitted fabric of firm yarn structure.

FINISHING

The term "finishing" usually includes all the mill processes through which a fabric passes after it leaves the loom. Dyeing, however, is often considered separately. Therefore the finishing of cotton materials may involve bleaching, mercerizing, waterproofing, fireproofing, or the application of various sizing mixtures to produce special surfaces. It may also include such mechanical treatments as napping and embossing. In fact, there are over a hundred different finishing processes in common use.

Cotton may be bleached in the raw state, in the yarn, or as the completed fabric. Then, too, even if the raw cotton or yarn has been bleached, the fabric may be run through a second bleach in order to clear up any discoloration. Occasionally bleaching is improperly done and the cotton attacked in such a way that the strength of the fabric is lessened. When durability is the prime consideration, unbleached fabrics are preferable.

Mercerization (p. 2) may be done while the cotton is in the yarn or after the fabric is made. As mentioned before, this process adds materially to the strength of the fabric and may be done so skillfully that it resembles silk, and when specially calendered (ironed between heavy rollers) makes a good imitation of linen. Various patents have introduced finishing processes in which the fabric is treated alternately with sulphuric acid and the lye used in mercerization. By carrying this out under special conditions, transparent effects are produced which make possible many novelties.

Waterproofing[1] and fireproofing are complicated processes, although they may in some cases be carried out satisfactorily in the home. Since cotton is very inflammable, the use of more fireproofed material where there is any danger of contact with fire is to be recommended. At present there is only a very limited number of such materials on the market.

Sizing includes the application of stiffening mixtures to the warp yarns in order to strengthen them for weaving, and also to the finished fabric to give body and a satisfactory feel. The mixtures commonly used contain some kind of starch, a softening material such as tallow or glycerine, a compound to prevent mildew, and materials to add weight. In fabrics such as paper cambrics and buckram, extra weight is desirable, but in most cases the real nature of the cloth is concealed by weighting. If such a fabric, with a loosely woven, coarse foundation is laundered, all its beauty and its usefulness are lost and the purchaser finds that a false value has been ascribed to it.

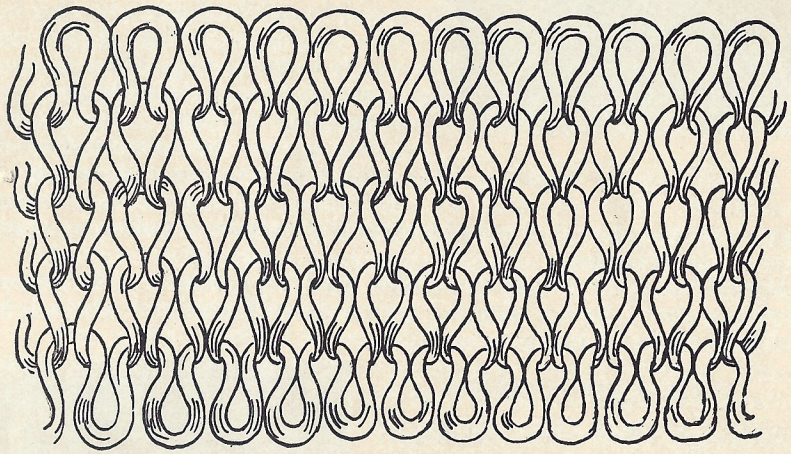


FIG. 14.—The plain knitting stitch

Patented processes employing albumin and casein solutions produce fabrics with more permanent stiffness, such as some of the best grades of organdie.

Napped cotton fabrics, such as cotton blanketing or outing flannel, are produced by passing the fabric through a napping machine

[1] Waterproofing and mildewproofing of cotton duck. H. P. Holman, B. S. Levine, and T. D. Jarrell. U. S. Dept. Agr., Farmers' Bull. 1157.

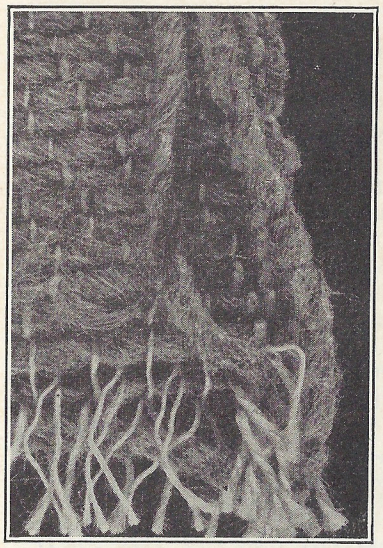


FIG. 15.—Blanket fabric before it is napped

which, by means of wire brushes, roughs up the fiber. This process, of course, removes fiber from the body of the fabric, and if carried to an extreme or if done on a thin fabric would soon destroy it. When heavy nap is desired, the foundation fabric must contain heavy yarns, with enough fiber to admit of dividing it between the nap and the foundation. (Fig. 15.)

The warmth of a blanket depends largely upon the thickness and fluffiness of this nap and is greatly reduced as wear and laundering mat down and remove nap. Some commercial laundries have napping machines through which they pass blankets in order to produce as much nap as they had originally and thus restore their warmth. This is helpful, but can not be done indefinitely, as every napping removes fiber and tends to wear through the foundation. The structure of the foundation fabric is therefore important and should always be carefully examined before a napped material is purchased.

Heavily napped cotton resembles wool very closely. At present there are many lightly napped cotton dress flannels on the market and napped twills made to resemble suede leather. (Fig. 16.)

JUDGING THE FINISHING

Although efforts are continually being made by the industry to produce permanent finishes, these have not always been successful. One of the best ways to demonstrate the permanence of the finish and prevent disappointment, is to wash a sample of the fabric. Excessive weighting material can often be noted by rubbing the fabric between the hands or holding it where a strong light can shine through it. Improper bleaching can be detected by gently pulling the fabric both ways and noticing any weakness. Napped fabrics are often mistaken for pile ones. If the latter are well constructed, they wear much longer than napped materials.

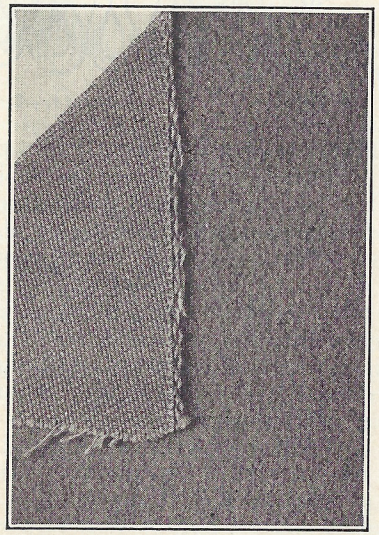


FIG. 16.—Cotton material napped to resemble suede leather

DYES

The dyes used to color a cotton fabric determine in many cases the satisfaction obtained from it. Whether or not they are "fast" is a matter which must be considered, but this term is often very loosely used. A dye that is really "fast" would remain permanently on a fiber under all conditions. No dye yet discovered will do this, and such permanency is not needed for ordinary purposes. On the other hand, it is essential that the dye last during the lifetime of the fiber and withstand the conditions under which the fabric is used, but not necessarily others. For example, a curtain fabric need not be fast to perspiration, but to give satisfaction it should be fast to light. In fact, the conditions should always be stated when fastness is mentioned.

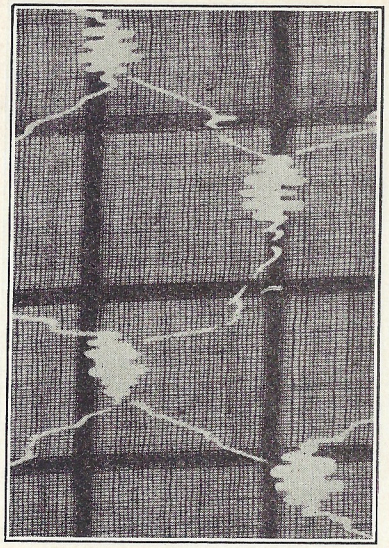


FIG. 17.—A discharge pattern produced to resemble lappet weaving

Color may be introduced in a fabric either by dyeing or by printing. The chief difference is that in dyeing the material is soaked in a dye solution, while in printing the dye is part of a paste stamped onto the fabric or yarn by rollers of a printing machine. In general, dyed fabrics retain their original appearance much longer than printed ones, although the quality of dye may vary greatly in either case.

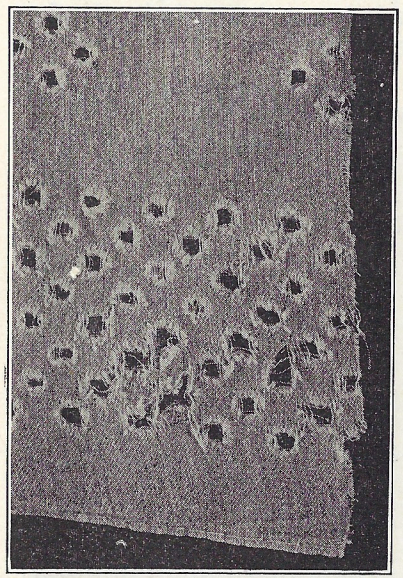


FIG. 18.—Worn places resulting from improperly produced discharge pattern

The dye may be applied to the raw cotton, to the yarn, or to the fabric. Under equal conditions dyeing the raw cotton allows better penetration and gives a more lasting effect, although when properly carried out either yarn or piece dyeing may be satisfactory.

Cotton fabrics are often printed in the piece. This can usually be seen by noticing that the back of the fabric is not dyed. However, yarns can be printed with colors at regular intervals, so that when they are woven into the fabric desired colors coincide and a design is produced. Sometimes mottled effects are so obtained.

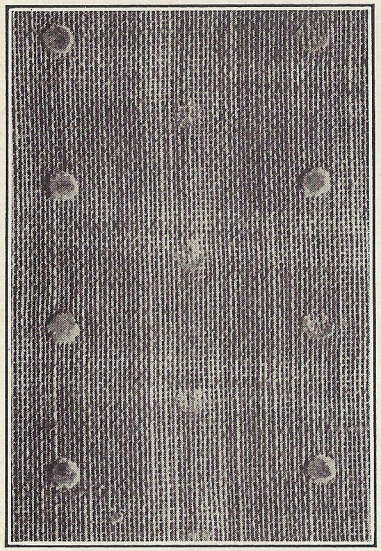


FIG. 19.—A fabric with paste dots discolored and in some cases removed by laundering

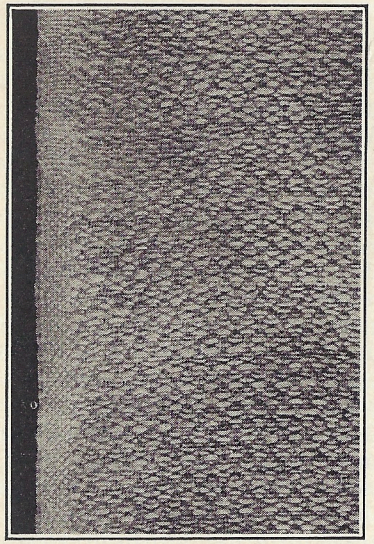


FIG. 20.—Birdseye diaper cloth

Discharge printing is also common on cotton fabrics. The cotton is dyed in the raw, in the yarn, or in the piece; then a paste, which by chemical action bleaches out a pattern, is applied with rollers. A discharge pattern produced in imitation of lappet weaving is shown in Figure 17. White dots or small patterns are often produced on dark backgrounds in this way. If this is not done wisely, the fabric may wear out quickly where the color was discharged. The worn

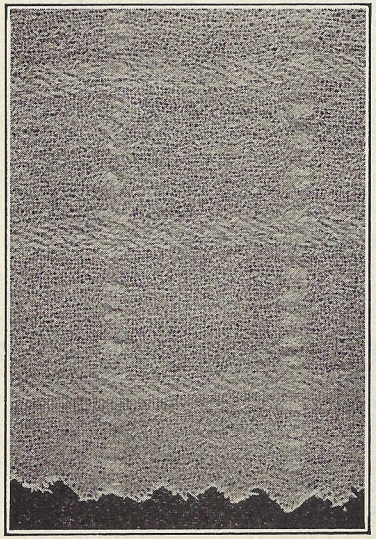


FIG. 21.—Crêpe

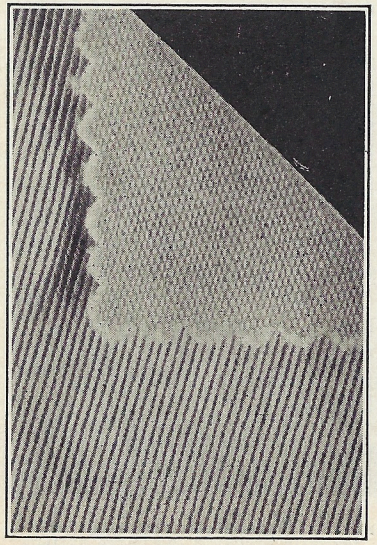


FIG. 22.—Gabardine, a typical twill weave

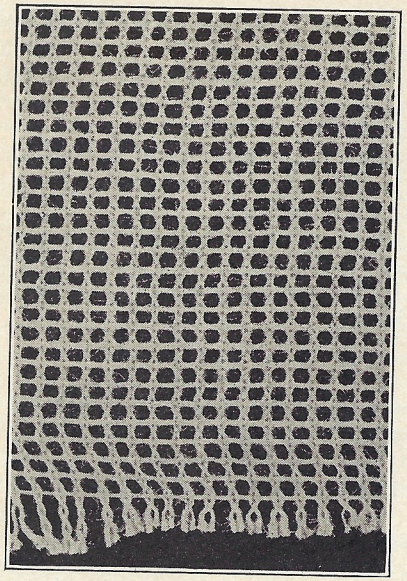


FIG. 23.—Marquisette, a typical gauze weave

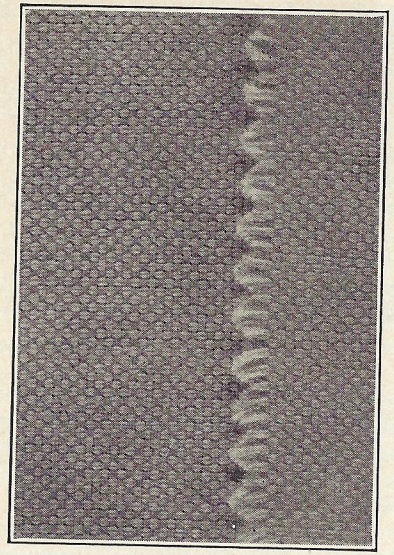


FIG. 24.—Oxford shirting, a typical basket weave

places in the fabric shown in Figure 18 were originally white spots produced on a dark-blue background by discharge printing.

Raised colored or white dots and figures may be applied as a paste by similar machines. In some cases these wash or rub off easily, and such fabrics should not be chosen if they must be laundered often or exposed to much wear. (Fig. 19.)

In both dyeing and printing, compounds called dyestuffs are used. Most of these are manufactured now, although some natural dyes

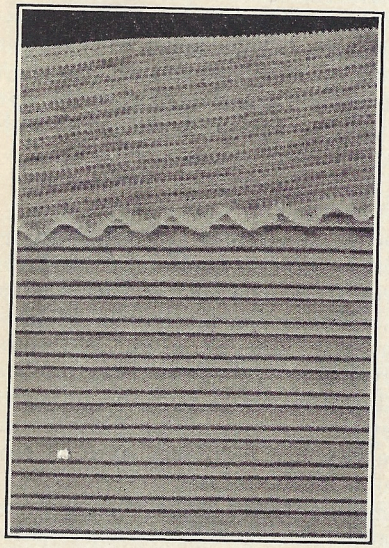


FIG. 25.—Piqué

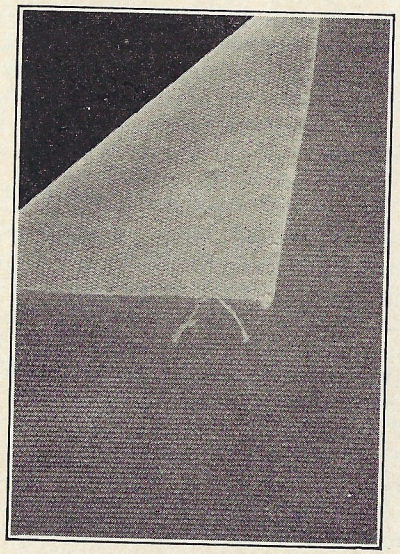


FIG. 26.—Poplin

obtained from plants and animals are used. Many of the so-called artificial dyes have exactly the same composition as the coloring matters obtained from natural sources, and some of them are far superior. Thus the prejudice against artificial dyestuffs is unfounded and the longing for the natural dyestuffs of long ago a great mistake. Since dyes can be made from the compounds found in coal tar, they are often called "coal-tar dyes" and also "aniline" colors, because aniline is important in their manufacture.

The dyestuff found on a given cotton material may be any one of hundreds of possible compounds and to identify it exactly might be a laborious process. It can usually be readily placed by a chemist into one of the following general classes:

SUBSTANTIVE DYES

These are dyestuffs that will adhere to a fiber without the addition of a "handle" or mordant, a compound which, by combining with both the dye and fiber, holds the dye onto a fiber to which it would not otherwise adhere. These substantive dyes are further divided into four types:

Direct, or salt, colors are the easiest dyestuffs to manufacture and therefore the cheapest. They are, however, the most fugitive, and the difficulties experienced with certain cotton colors are usually due to the fact that a dye of this group is being used.

Sulphur colors are so named from the fact that they contain sulphur. They are more fast than the direct colors, but most of them are of dull shades and therefore somewhat limited in use. Sulphur blacks are very much used, especially in dyeing cotton hosiery. Under conditions of wear, they may liberate sulphuric acid, and some of the weakening of cotton fabrics so dyed can be attributed to this.

Vat dyes are the best cotton dyes known at present and are widely used on fabrics which withstand wear and launder well. They are the most difficult of all to make and are the most expensive.

Developed dyestuffs are valuable dyes obtained by rather complicated processes. The material, usually in the form of yarn, is thoroughly impregnated with one compound, then passed through various baths that react with the first and form a dye. Since the dye is thus made right on the fiber, it is very fast and compares well with many of the vat dyes in this respect.

ADJECTIVE DYES

Cotton is also dyed with the use of mordants, and such colors are very satisfactory. Tannic acid is a common compound used for this purpose, since it will adhere strongly to the cotton fiber on one hand and to the dye on the other. There are a number of such materials; but the common idea that salt, vinegar, alum, and some other substances used in household dyeing are mordants is erroneous. These are assisting agents which affect the shade and the quantity of dye deposited on the cloth, but they are not mordants. On account of the extra processes and therefore expense involved, dyes of this class are not used so extensively as some of the others.

The color of a cotton fabric depends entirely upon the chemical composition of the particular dye used. Every color is represented in each class with the exception of the sulphur colors, no successful red sulphur dye having yet been made. The dyes in one class differ in properties from the dyes of another class, because they are of different composition.

JUDGING THE FASTNESS OF THE COLOR

It is a common fallacy that green, or some other color, is much less fast than blue. If these colors happen to belong to the same class, there is logic in such a comparison; but the consumer usually does not know to what class they do belong and may be comparing a member of the poorest class with one of the best. All green dyestuffs do not have the same qualities of fastness, not only because they may be members of entirely different classes, but also because individual members may differ slightly among themselves. Fastness is a matter of chemical constitution and not of color.

In this connection many housewives often speak of "setting" or "mordanting" a color and feel that they increase the fastness by soaking the fabric in alum, salt, or other solutions. These are not cotton mordants, and the effect produced is very slight and largely a waste of time.

The only way for a consumer to protect herself from unsatisfactory dyes is to take a sample of the fabric home and submit it to the conditions under which it is to be used. For example, cover a part of the sample with cardboard and expose the rest to direct sunlight for at least a week. Remove the cardboard occasionally, and compare the exposed and unexposed portions. Wash a sample under ordinary conditions and note whether it fades. Test a piece in a solution of Javelle water if the fabric is likely to require bleaching.

The method which has been used in dyeing the fabric can often be determined by unraveling a few yarns. If it has been piece dyed with poor penetration, there will be undyed spots where the yarns crossed in weaving. A piece-dyed fabric is always the same color throughout, including the selvage. If it has been yarn dyed with poor penetration, untwisting the yarn will reveal undyed fibers in the center, although the entire surface of the yarn may be properly colored. Often the color appears to wear off of such a fabric, owing to the fact that the outer surface of the yarn is removed and the undyed portions made visible. If the yarn has spots of different colors, it has been printed.

Thus, the wise selection of a cotton fabric must be based on general knowledge and appreciation of the fiber itself and of textile-manufacturing processes, including the new ones constantly being introduced. These technical facts must be supplemented also by the practical knowledge that comes from handling a great many fabrics and observing how they stand the wear and tear of everyday use.

GLOSSARY OF SOME COMMON COTTON FABRICS[2]

Ada or Aida canvas.—A stiff, coarse fabric usually of the basket weave, with accurately spaced square meshes. Tan or brown. Uses: Cross-stitch and other art needlework.

Agaric.—Loop pile fabric similar to a fine Turkish toweling. Loops formed by the warp. All colors. Uses: Dresses.

Albatross.—Soft, lightweight cotton fabric made in imitation of the worsted of

[2] This compilation was made in part from material found in the Dictionary of Textiles, Louis Harmuth; Cotton Fabrics Glossary, Frank P. Bennett; Fabrics and How to Know Them, Grace Denny; Glossary of Textile Terms, Harry P. Curtis; and from other well-known glossaries.

the same name. Plain weave with fleecy surface. Solid colors, piece dyed. Uses: Flags, bunting, kimonos, house dresses.

Apron checks.—Ginghams woven with small checks of white and blue or other single color. Usually made of coarser yarns than dress ginghams. Uses: Aprons.

Armure.—Related to rep. Woven figures produced by warp on a rep foundation. Plain or mixed colors. Uses: Couch covers, draperies, upholstery.

Art ticking.—*See* **Ticking.**

Bathrobe cloth.—Thickly napped double-faced blanketing. All colors. Uses: Kimonos, bathrobes.

Batiste.—Named from Baptiste, a linen weaver who is alleged to have first made it in the thirteenth century. Plain weave. Usually made of fine, high quality yarn. Soft, lustrous (mercerized) finish. White or delicate colors. Uses: Best grades, lingerie, infants' wear, sheer dresses; poorer grades, linings.

Bedford cord (cotton).—Heavy or medium weight fabric with raised cord or ridge effect running warpwise a warp piqué. White or colors. Uses: Children's wear, skirts, dresses, sport costumes, men's vests, shirts, soft collars.

Birdseye diaper.—Woven in typical birdseye pattern. Soft and absorbent. White. Uses: Diapers and when absorbent cloth is required. (Fig. 20.)

Bobbinet.—Netting with hexagonal meshes. Varies widely in fineness of yarns used and in closeness of mesh. White or colors. Uses: Curtains, linings, dresses, trimmings, veils, hat shapes.

Broadcloth shirting (cotton).—Resembles fine poplin but differs in that the warp and filling yarns are of the same counts and that there are at least 60 filling yarns to the inch. Plain weave with the warp much closer spaced than the filling. Fine ridges from selvage to selvage. White or colors. Uses: Shirts, dresses, skirts.

Buckram.—A plain weave fabric that owes its value to its heavy sizing of starches, gums, and glues. Black or white. Uses: Millinery frames, linings for stiffening garments.

Bunting.—Lightweight, soft fabric. Plain weave. Heavier than cheesecloth. All colors. Uses: Flags, decorative purposes.

Cable net.—Netting with coarse mesh; made of heavy yarns. White or colors. Uses: Curtains.

Calico.—Name derived from Calicut, India, where printed cloth originated. A plain-woven fabric of medium yarns. Usually printed in one or more colors on a light ground. Figure produced by "resist" and "discharge" printing also common. Uses: Dresses, aprons.

Cambric.—Name derived from Cambrai, France. Closely woven fabric of fine yarns with a characteristic soft finish. Generally firmer and of heavier finish than nainsook. Plain weave. Some qualities heavily filled and glazed. White or colors. Uses: Underwear, dresses, aprons, linings.

Canton flannel.—Twilled fabric woven of coarse yarns with long nap raised on one side. White or colors. Uses: Underwear, sleeping garments, linings.

Canvas.—Heavy fabric of coarse ply yarn. General term for heavier grades of cotton duck. Plain weave. White, with or without colored stripes. Uses: Sails, tents, awnings, hammocks. *See* **Ada canvas** and **Cross-stitch canvas.**

Casement cloth.—This term covers many drapery materials in various weaves and colors.

Challie or challis (cotton).—Soft-finished calico. An imitation of wool challis. Plain weave. Plain colors or printed in all-over figured or floral designs. Uses: Draperies, linings, dresses, comforters.

Chambray.—Plain weave, smooth, shiny surface. Similar to gingham. No pattern, but colored warp and white filling. Always has a white selvage. Uses: Dresses, aprons, shirts, children's garments.

Cheesecloth.—Plain, loosely woven, thin, lightweight fabric. Yarns of same size as those in calico but much more open construction. White or colors. Uses: Curtains, flags, decorative purposes, linings, bandages, dust cloths, wrapping for cheese and butter.

Cheviot shirting.—Stout fabric of coarse yarn in imitation of wool cheviot. Plain or twill weave. Stripes or checks. Usually blue and white warp and white filling. Uses: Chiefly shirts, but also dresses and children's wear.

Chintz.—Hindu word meaning variegated. Plain weave. Often starched and glazed. Printed in small designs, usually in bright colors. Uses: Draperies; more subdued patterns for dresses.

Corduroy.—Derived from French *corde du roi*, meaning "a king's cord." Twill or plain-woven foundation. Weft pile weave with rounded ridges or cords of the pile running lengthwise. White or colors. Sometimes printed. Uses: Suits, trousers, sport skirts, wraps, bathrobes, hangings.

Coutil.—French for "drill." Commonly known as "corset cloth." Constructed to withstand much wear and stretch. Varies from herringbone twills to elaborate Jacquard brocades. White or colors, with fancy stripes or figures. Uses: Corsets and other garments requiring great durability.

Crash.—Rough, closely woven fabric of coarse yarns. Usually plain weave. White, unbleached, or dyed. Uses: Dresses, hangings, art needlework; narrower widths, toweling.

Crêpe (cotton).—Lightweight fabric of crinkled surface. Plain weave. All colors. Uses: Dresses, kimonos, undergarments, sleeping garments. (Fig. 21.)

Cretonne.—Plain-woven fabric similar to chintz but with larger designs, heavier yarns, and coarser construction. Not glazed. Printed in various colors. Uses: Hangings, upholstery, and furniture covers.

Crinoline.—Plain-woven fabric, highly sized with glue and starches. Dull or glazed. White, gray, or black. Uses: Inner linings, especially in millinery.

Cross-stitch canvas.—Heavy, open fabric. Plain weave. White or tan, with or without bars of colored yarn at intervals. Uses: Cross-stitching.

Damask.—Jacquard-woven fabric distinguished by the fact that the design shows on the smooth surface without the necessity of any contrast in color. White or colors. Uses: Tablecloths, napkins.

Denim.—Strong, warp-faced twill. Warp is usually blue or brown and the filling of "mock-twist" yarn. Some are made with white filling. A grade known as covert cloth is made with blue and white twisted warp yarns and dark-colored single filling. Uses: Overalls, work clothing; finer qualities, draperies, upholstery, and furniture covers.

Dimity.—Name derived from Latin *dimitum*, meaning "of double thread." A thin, sheer fabric with corded checks or stripes. White or colors. Uses: Dresses, aprons, curtains, lingerie, infants' wear.

Drill or drilling.—Heavy, durable twilled fabric of coarse yarns. White or colors. Uses: Trousers, skirts, middies, uniforms.

Duck.—So called because it sheds water. Heavy, coarse, plain-woven material. Usually with each alternate pair of warp ends woven as one. Often sold in grades by weight, designated in ounces, or by number. White or colors. Uses: Harvester machine screens, tents, boat sails, awnings; finer qualities, skirts, suits, middies.

Éponge.—Soft, coarse fabric made with novelty yarns. Similar to ratiné. Plain weave. White or colors. Uses: Dresses.

Étamine.—French word meaning "bolting" or "sifting" cloth. Originally applied to cloth used for that purpose. Plain-woven, thin, glossy material similar to bunting. White or colors. Uses: Dresses, draperies.

Eiderdown.—Thick, soft fabric, knitted foundation, thick nap. White, plain colors, or colored patterns. Uses: Bathrobes, infants' coats, and blankets.

Filet net.—Square-mesh netting. White or colors. Uses: Curtains.

Flannel (cotton) or flannelette.—Plain-woven or twill-woven fabric with smooth or napped surface. White or colors printed on plain surface. Uses: Dresses, shirts, kimonos.

Foulard (cotton).—Highly mercerized fabric resembling silk foulard. Twill weave. Plain colors or printed. Uses: Dresses, linings, comforter coverings.

Gabardine (cotton).—Twilled fabric. Fine but distinct diagonal cords. White or colors. Uses: Suits, skirts, wraps; may be waterproofed for raincoats. (Fig. 22.)

Galatea.—Firm, closely woven fabric of coarse yarns. Very durable satin (warp sateen) or sometimes twill weave. White and colors. Sometimes printed with stripes or other designs. Uses: Children's garments, skirts, suits, middies, uniforms.

Gingham.—Plain-woven fabric of yarns of medium counts. Stripes, checks, and plaids formed of dyed yarns. Uses: Dresses, shirts, children's garments.

Chambray gingham: Plain colored, white filling.

Nurses gingham: Blue and white stripe, closely woven.

Scotch gingham: Fine quality, made in Scotland.

Tissue gingham: Thin fabric with heavy cord.

Zephyr gingham (also French gingham): Fine, soft-finished fabric.

Glass toweling.—Plain-woven fabric of tightly twisted yarns. Glazed finish. White with red or blue stripes forming checks. Uses: Dish towels.

Granite cloth.—Fancy irregularly woven fabric; yarns twisted so as to give a pebbled surface. Various colors. Uses: Dresses.

Grenadine.—Similar to marquisette and commonly known by that name. Woven to give lacy effect. Leno or gauze weave. White or colors. Uses: Dress trimmings.

Hardanger cloth.—Basket weave. White or écru. Uses: Hardanger embroidery.

Hickory.—Very stout, durable, coarse shirting. Twill weave. White, with usually blue or brown lengthwise stripes. Uses: Shirts, work clothes.

Honeycomb toweling.—Rough material. Twill weave with diamond patterns constituting the so-called honeycomb weave. White or colors. Uses: Towels.

Huckaback or huck.—Rough-surfaced fabric, usually honeycombed or with other geometrical designs. White or colors. Uses: Towels.

Jean.—Resembles drill, but finer. Stout and durable. Twill weave. White, plain colors, or stripes. Uses: Work garments, children's clothing.

Khaki-twill.—Khaki is East Indian word for "dusty." Used first in India. Twill weave. Strong fabric dyed yellowish tan. Uses: Uniforms, outing costumes.

Kindergarten cloth.—Plain weave, firm material, similar to gingham but heavier. All colors. Uses: Children's clothing, dresses.

Lawn.—Name derived from Laon, France. Fine, sheer fabric with crisp, linen-like finish. Plain weave. White, piece-dyed, or with printed designs. Uses: Dresses, underwear.

Linen-finished suitings.—Large class of fabrics sold under various trade names. Heavy with coarse yarns finished to imitate linen crash suitings. Vary in weight and finish. White or colors.

Longcloth.—Medium-weight, plain-woven fabric. Usually closer weave than batiste, fine muslin, or cambric, and with little or no sizing. White. Uses: Underwear, uniforms.

Lustrine.—Very smooth fabric. Satin weave. Warp yarns sized and polished in imitation of horsehair yarns. All colors, but usually black or striped. Uses: Coat sleeve lining.

Madras.—Originally a fabric made in Madras, India, for head dresses. Drapery: Thin material with figures of mercerized cotton or other fiber introduced on a leno-woven foundation. Floats are sheared between figures, leaving rough effect. White or colors with figures of same or contrasting shades. Uses: Curtains. Shirting: Plain or fancy woven fabric with characteristic white or colored warp stripes usually forming fine ribs. White, plain, or with colored stripes and figures. Uses: Shirts, shirtwaists, dresses.

Marquisette.—Lightweight fabric, open texture. Gauze or leno weave. Very sheer. The name is sometimes applied to coarse plain weaves commonly known as scrim. White, écru, or colors. Uses: Curtains, dresses. (Fig. 23.)

Marseilles.—Originally made in Marseilles, France. Heavily corded, double faced with raised pattern. White. Uses: Bedspreads.

Masalia cloth.—Fine material like nainsook. Slight luster. White. Uses: Infants' dresses, underwear.

Middy twill.—Twilled fabric similar to drill or jean. White or colors. Uses: Children's clothes, skirts, middies.

Monk's cloth.—Heavy, rough drapery material. Basket weave. White or dark shades. Also known as friars' cloth, druid cloth, and mission cloth. Uses: Draperies, upholstery. (Cover design.)

Mosquito netting (or bar).—Heavily sized, coarse, square-meshed fabric. Plain or barred. Leno weave. The most durable is a bobbinet. White or colors. Uses: Screens.

Mull.—Derived from word *mal* in Hindu, meaning "soft." Plain, sheer fabric, similar to lawn, but sized to give soft finish. Highly mercerized. White or colors. Uses: Dresses; starched mull, millinery purposes.

Muslin.—Named from city of Mosul. Plainly woven fabric. Variety of grades. Better qualities have little or no sizing. The same fabric may be so finished that it is given a different name, such as "nainsook," "batiste," "lawn." White or unbleached. Very fine qualities suitable for dresses either piece-dyed or printed. Uses: Underwear, sheeting, various household purposes.

Nainsook.—Derived from Hindu words meaning "delight of the eye." Soft, fine plain-woven fabric. Very slightly sized. Usually finer and lighter than cambric. May be mercerized. Often polished on one side. White. Uses: Dresses, underwear.

Organdie.—Very sheer, stiff, translucent fabric. Either heavily sized or specially treated to produce a characteristic